FEMA 1.2:C9: 390139

FLOOD INSURANCE STUDY

CITY OF GREENVILLE, OHIO
DARKE COUNTY

SEPTEMBER 29, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER 390139

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY

CITY OF GREENVILLE,
DARKE COUNTY,
OHIO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and supersedes a previous Flood Insurance Rate Map for the City of Greenville, Darke County, Ohio (Reference 1). This information will be used by the community to update existing floodplain regulations as part of the regular phase of the National Flood Insurance Program. The information will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared by the Federal Emergency Management Agency (FEMA) for purposes of the National Flood Insurance Program.

The data were identified as applicable at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. FEMA performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the National Flood Insurance Program. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the Natural and Technological Hazards Division, FEMA, Chicago, Illinois, for consideration for revision of this study.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were obtained from the Flood Insurance Study for Darke County, Ohio (Reference 2).

1.3 Coordination

Streams requiring detailed study were identified at a meeting in December 1985 attended by representatives of the Study Contractor, FEMA, and Darke County.

On November 16, 1988, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the community and FEMA.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Greenville, Darke County, Ohio. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected based on the extent and validity of available existing hydrologic and hydraulic data.

Flooding caused by overflow of Greenville Creek was studied in detail.

2.2 Community Description

Greenville, the county seat of Darke County, Ohio, is near the center of the county and is surrounded by the unincorporated areas of the county. Major highways serving the community include U.S. Route 127 and State Routes 49, 118, 121, 502, and 571. The 1980 population of Greenville was reported to be 12,999 (Reference 3).

The climate of Greenville is characterized as continental, with large seasonal and day-to-day variations in temperature. Summers are moderately warm and humid, with occasional days when the temperature exceeds 90 degrees Fahrenheit. Winters are cold and cloudy. The average annual precipitation is 36.4 inches, with about 20 inches, or 55 percent, usually falling from April through September. Average seasonal snowfall is 36 inches. The greatest snow depth at any one time during the period of record was 14 inches. On the average, 22 days have at least 1 inch of snow on the ground (Reference 4).

Although Darke County is predominantly agricultural, residential development is constantly taking place.

2.3 Principal Flood Problems

The major flood threat within Greenville is from Greenville Creek. The problems are created by a concentration of development susceptible to damage within the floodplain of Greenville Creek. Poor natural drainage is a major factor in the flatter areas and erosion is a hazard in sloping areas (Reference 5).

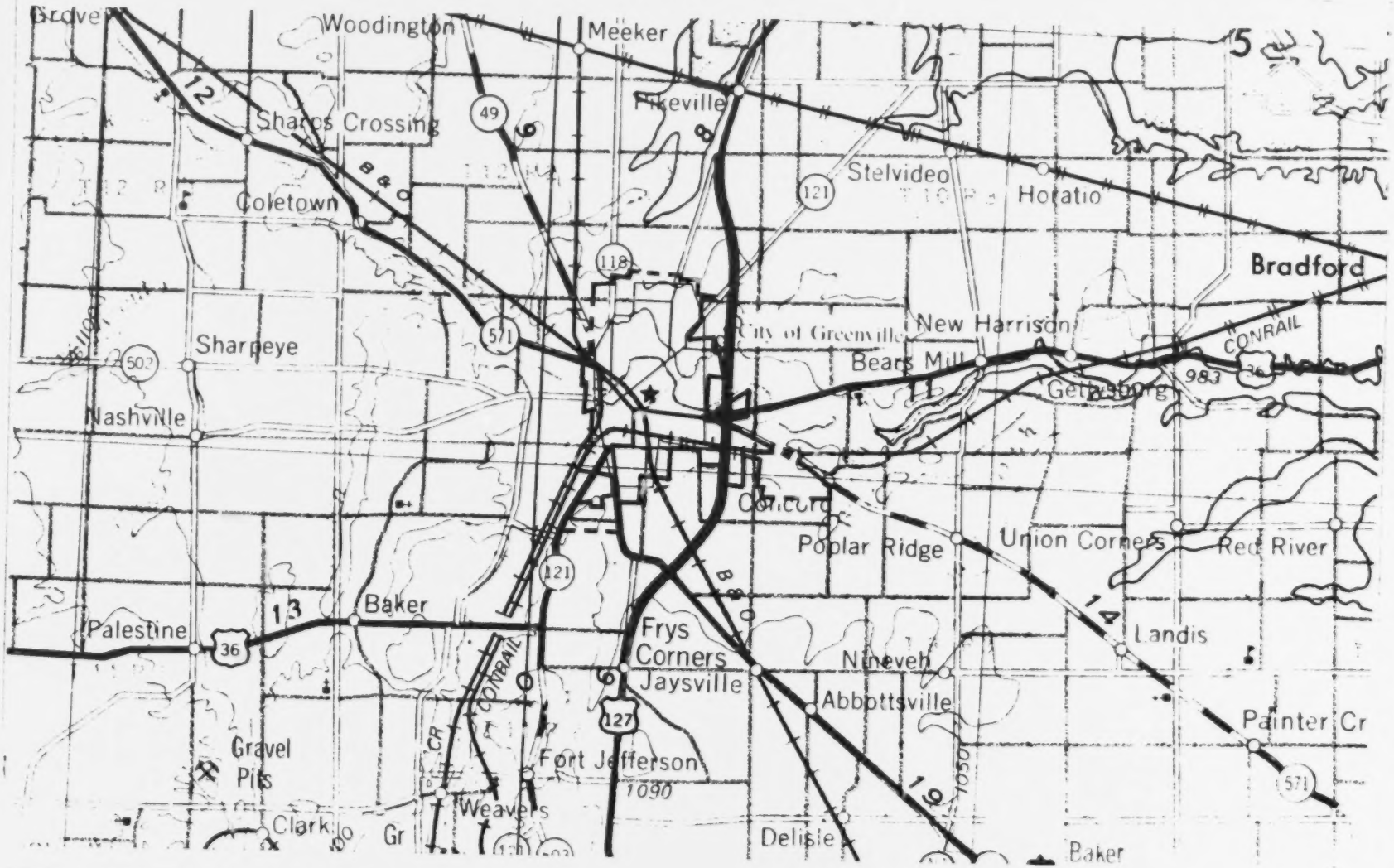

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GREENVILLE, OH
(DARKE CO.)

APPROXIMATE SCALE

VICINITY MAP

2.4 Flood Protection Measures

Flood protection measures are not known to exist within the study area.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

A U.S. Geological Survey gage with 63 years of record is on Greenville Creek below the Village of Bradford. Floodflow frequency data at the gage were determined using Bulletin No. 17B (Reference 6). Frequency discharges upstream of the gage at Greenville were established using square root-drainage area proportion.

Peak discharge-drainage area relationships for the 100-year flood of Greenville Creek are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 100-YEAR
GREENVILLE CREEK		
just downstream of confluence of Mud Creek	142	8,820
just upstream of confluence of Mud Creek	107	7,970

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for Greenville Creek were obtained from field survey data and detailed mapping developed from aerial photography. The cross sections were located at bridges and at close intervals above and below the bridges in order to compute the backwater effects of these structures.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map.

Roughness coefficients (Manning's "n") for the water-surface computations were assigned on the basis of field inspection of the channel and floodplain and reproduction of known high-water marks from the March 1963 flood of Greenville Creek. Roughness values for Greenville Creek range from 0.04 to 0.06 for the channel and from 0.045 to 0.075 for the overbank areas. Water-surface elevations for the 100-year flood were computed using the HEC-2 step-backwater computer program (Reference 7). Starting water-surface elevations for Greenville Creek were determined using the slope-area method.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:200 with a contour interval of 4 feet (Reference 8).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 2, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and the 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. Portions of the floodway for Greenville Creek lie outside the corporate limits.

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause more than a 1.0-foot increase in the base flood elevations at any point within the community.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than the state's allowable surcharge at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

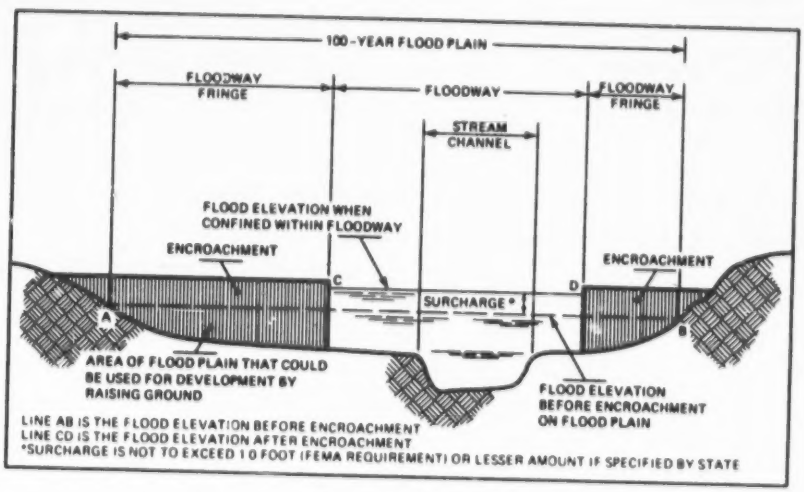
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE *
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
GREENVILLE CREEK								
A	975	195[2]	2070	4.3	1009.8	1009.8	1010.8	1.0
B	1667	169[2]	1991	4.4	1010.5	1010.5	1011.3	0.8
C	3525	140	1832	4.8	1011.8	1011.8	1012.7	0.9
D	4476	140	1873	4.7	1012.6	1012.6	1013.4	0.8
E	5019	129	1844	4.8	1013.0	1013.0	1013.7	0.7
F	5294	110	1699	5.4	1013.4	1013.4	1014.0	0.6
G	6118	160	1948	4.7	1014.1	1014.1	1014.9	0.8
H	7469	349	3572	2.6	1015.1	1015.1	1016.0	0.9
I	8050	212	2859	3.2	1015.2	1015.2	1016.2	1.0
J	8620	126	2116	4.3	1015.9	1015.9	1016.9	1.0
K	9228	149	2209	4.2	1016.3	1016.3	1017.3	1.0
L	9439	147	2331	3.9	1016.5	1016.5	1017.5	1.0
M	9782	137	2136	4.3	1016.6	1016.6	1017.6	1.0
N	10,600	484	4434	2.1	1017.1	1017.1	1018.1	1.0
O	11,646	411	3492	2.6	1017.3	1017.3	1018.3	1.0
P	12,111	261	2663	3.4	1017.4	1017.4	1018.4	1.0
Q	12,470	176	2178	4.2	1017.5	1017.5	1018.5	1.0
R	13,040	132	1869	4.9	1018.0	1018.0	1019.0	1.0
S	13,605	119	1714	5.4	1018.5	1018.5	1019.5	1.0
T	13,927	100	1652	5.6	1018.8	1018.8	1019.8	1.0
U	14,692	135	2095	4.4	1019.7	1019.7	1020.6	0.9
V	15,199	150	1994	4.0	1020.2	1020.2	1021.1	0.9
W	15,437	113	1870	4.3	1020.3	1020.3	1021.3	1.0
X	15,965	273	2739	2.9	1020.7	1020.7	1021.7	1.0

[1]FEET ABOVE CORPORATE LIMITS
[2]THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GREENVILLE, OH
(DARKE COUNTY)

FLOODWAY DATA

GREENVILLE CREEK

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

The Flood Insurance Study in progress for Darke County (Reference 2) is in agreement with this study.

This Flood Insurance Study supersedes the previously printed Flood Insurance Rate Map for the City of Greenville (Reference 1).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 175 West Jackson Boulevard, 4th Floor, Chicago, Illinois 60604-2698.

9.0 REFERENCES AND BIBLIOGRAPHY

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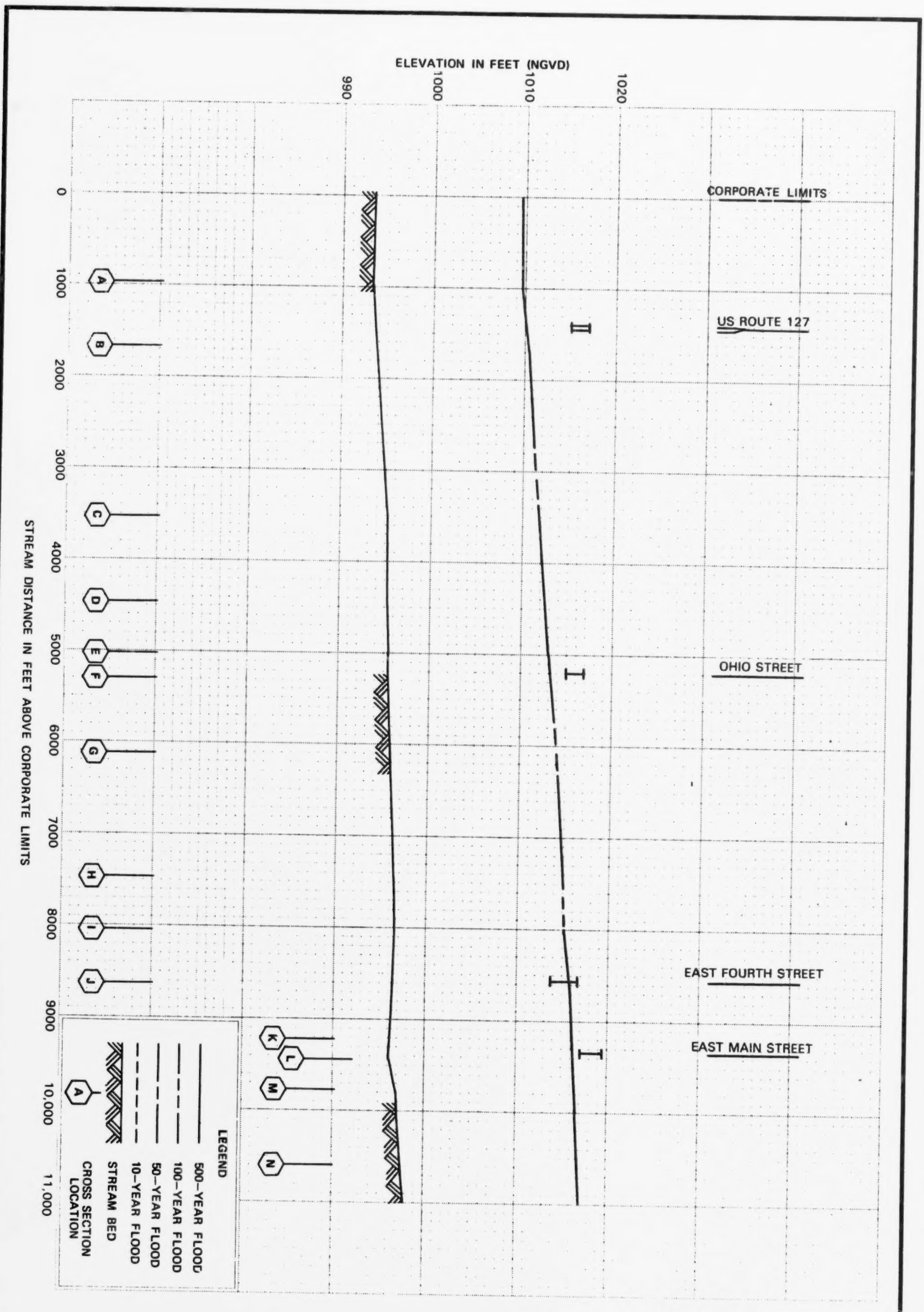
U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 5 Feet: Greenville West, Ohio, 1961; Greenville East, Ohio, 1961, photorevised 1973.

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0002	1,016.47	chiseled cross in concrete wingwall located on southeast side of Ohio Street bridge over Greenville Creek
2	0002	1,019.70	chiseled cross in concrete wingwall located on northeast side of Main Street bridge over Greenville Creek
3	0002	1,014.37	chiseled square in concrete base located on southeast side of footbridge over Greenville Creek
4	0002	1,033.91	chiseled cross on top of concrete wingwall located in southeast side of CSX railroad bridge over Greenville Creek
5	0002	1,029.42	chiseled square on top of concrete headwall located on southeast side of Conrail bridge over Greenville Creek



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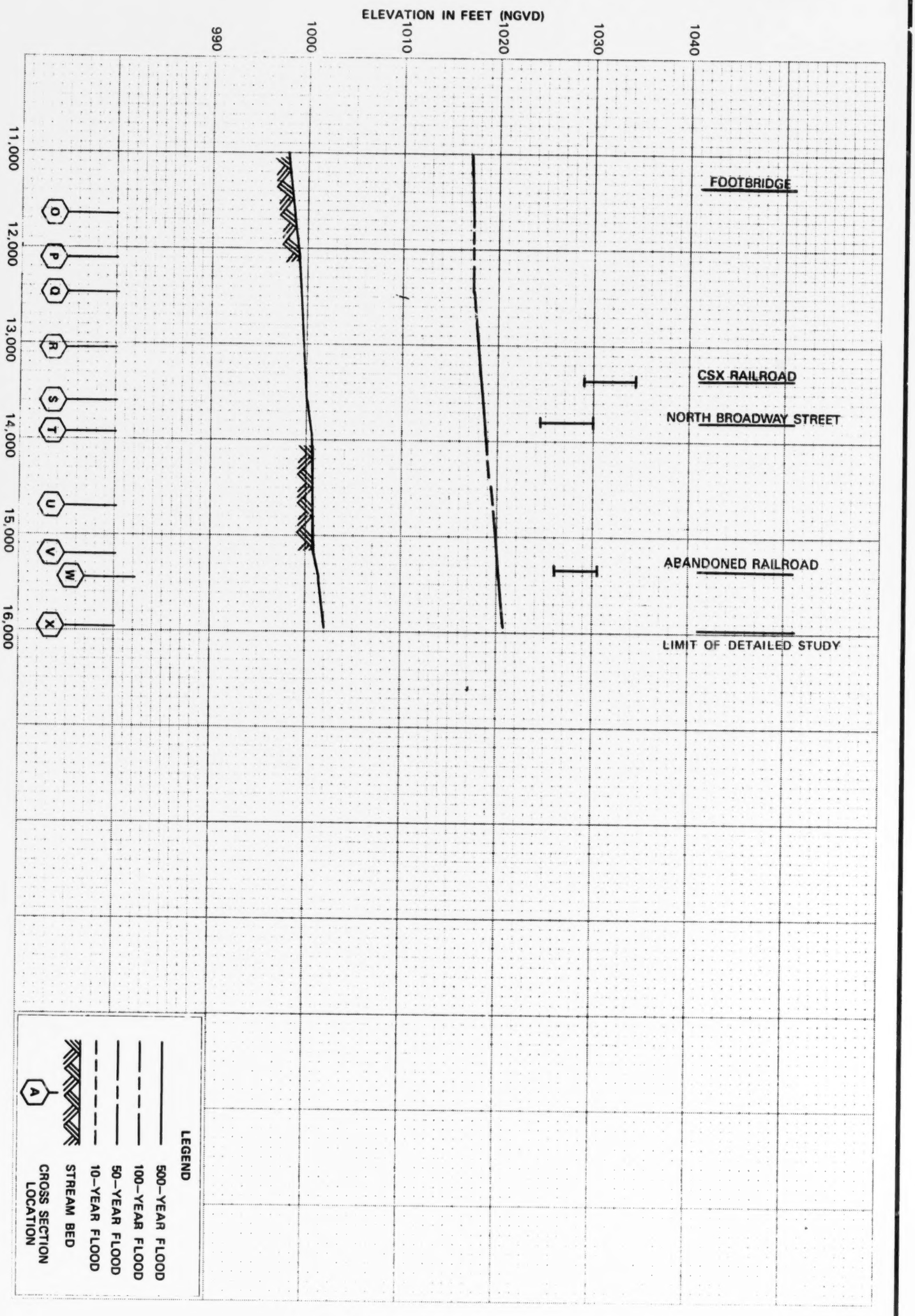
01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CITY OF GREENVILLE, OH** (DARKE CO.)	**FLOOD PROFILES** **GREENVILLE CREEK**



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02P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GREENVILLE, OH
(DARKE CO.)

FLOOD PROFILES

GREENVILLE CREEK